United States Patent [19]

Kaneko

[11] **Patent Number: 4,480,826**

[45] **Date of Patent: Nov. 6, 1984**

[54] **PAPER FEEDER**

[75] Inventor: **Midori Kaneko**, Sakai, Japan

[73] Assignee: **Hamada Printing Press Mfg. Co., Ltd.**, Osaka, Japan

[21] Appl. No.: **396,481**

[22] Filed: **Jul. 8, 1982**

[30] **Foreign Application Priority Data**

Mar. 11, 1982 [JP] Japan 57-39889
Mar. 11, 1982 [JP] Japan ..... 57-35442[U]

[51] **Int. Cl.**[3] **B65H 3/08**
[52] **U.S. Cl.** **271/103**; 271/31; 271/104; 271/152
[58] **Field of Search** ..... 271/103, 104, 30 R, 271/31, 152, 156

[56] **References Cited**

U.S. PATENT DOCUMENTS

2,224,802	12/1940	Spiess	271/103 X
2,341,521	2/1944	Baker	271/103
3,921,971	11/1975	Vollrath	271/103

Primary Examiner—Richard A. Schacher
Attorney, Agent, or Firm—Wenderoth, Lind & Ponack

[57] **ABSTRACT**

An improved paper feeder for use with a printing machine includes a suction head which moves up and down by suction force and moves forward and backward by action of a cam. The paper feeder further includes an arrangement for controlling the height of the paper table.

2 Claims, 10 Drawing Figures

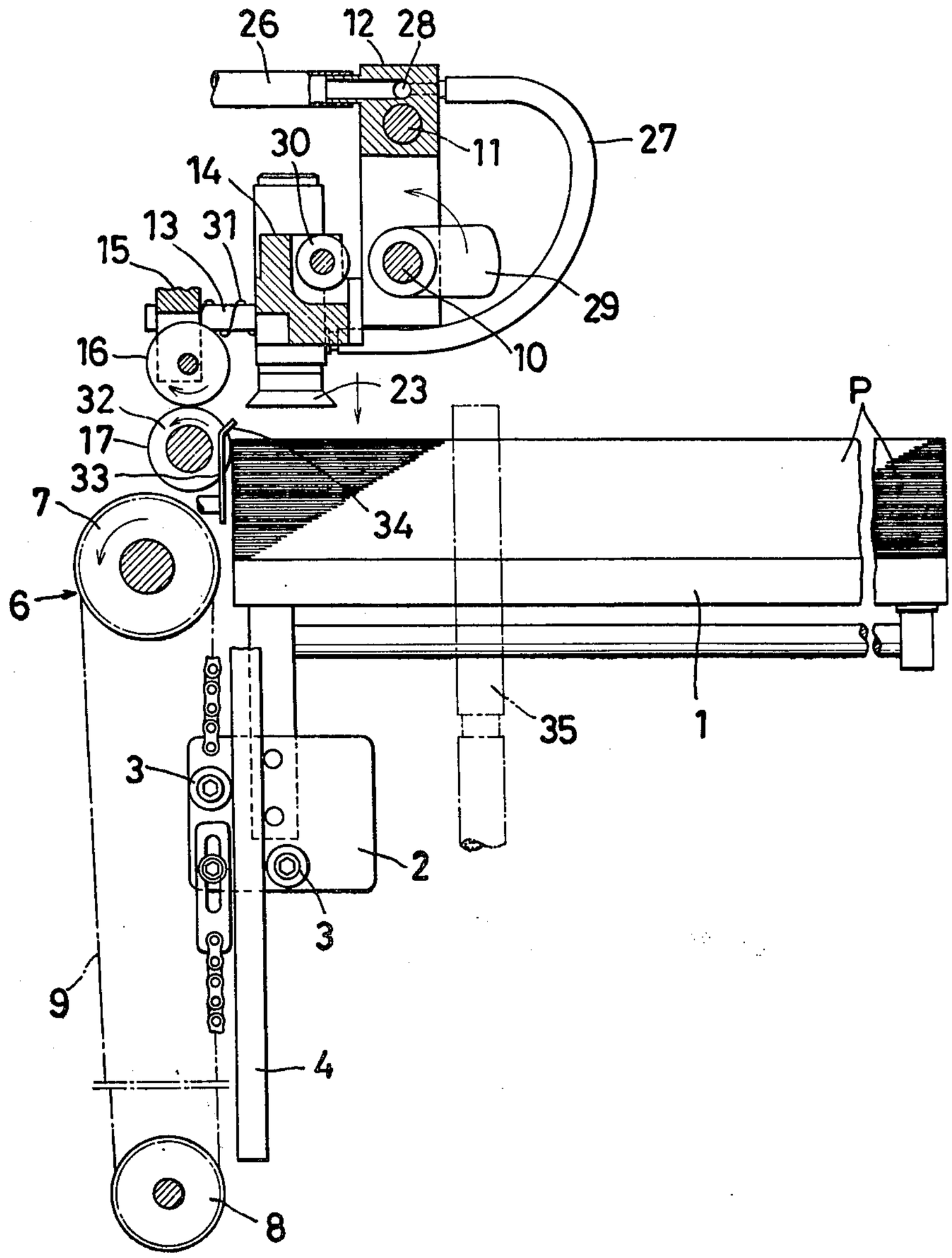


FIG.1
PRIOR ART

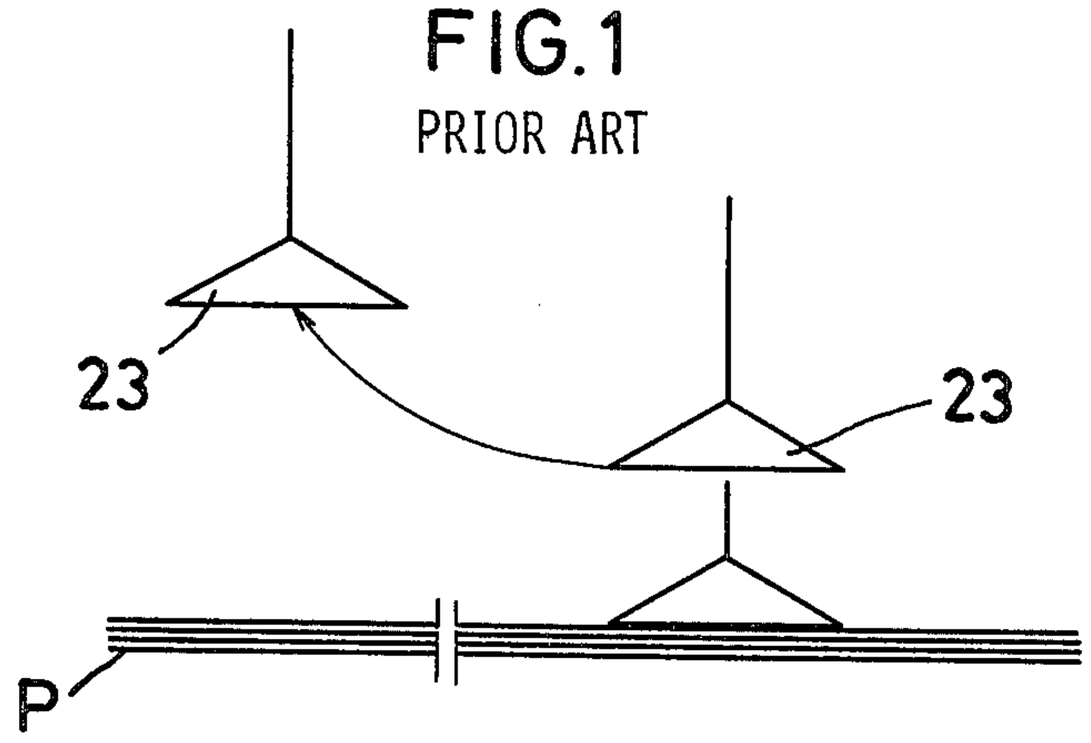


FIG.2
PRIOR ART

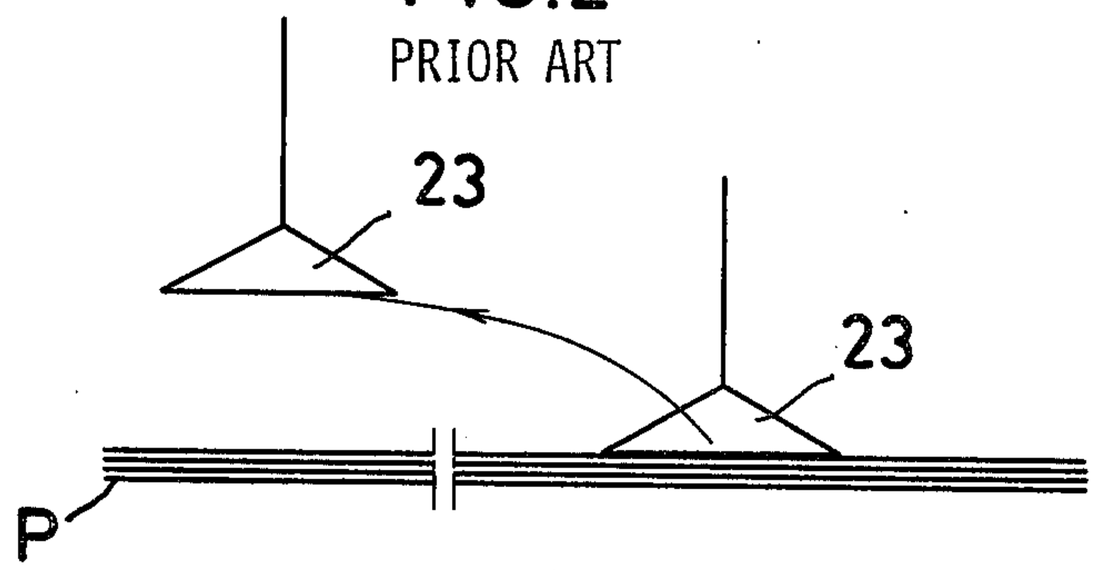


FIG.3

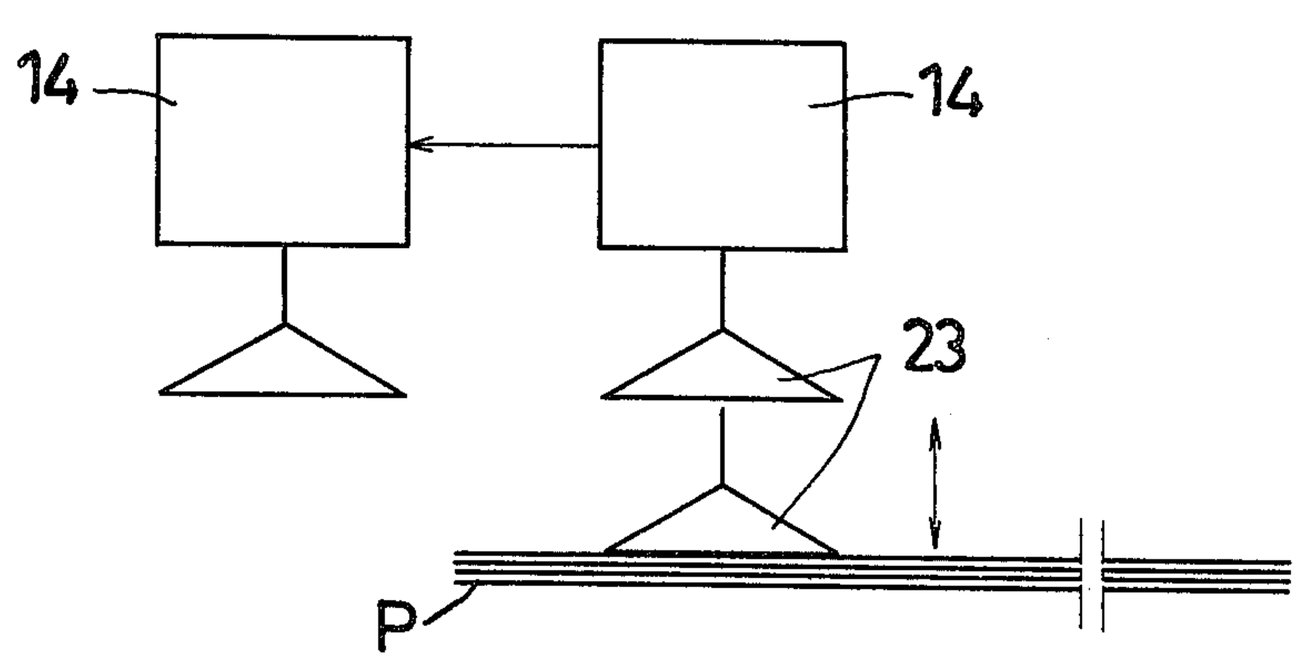


FIG.4

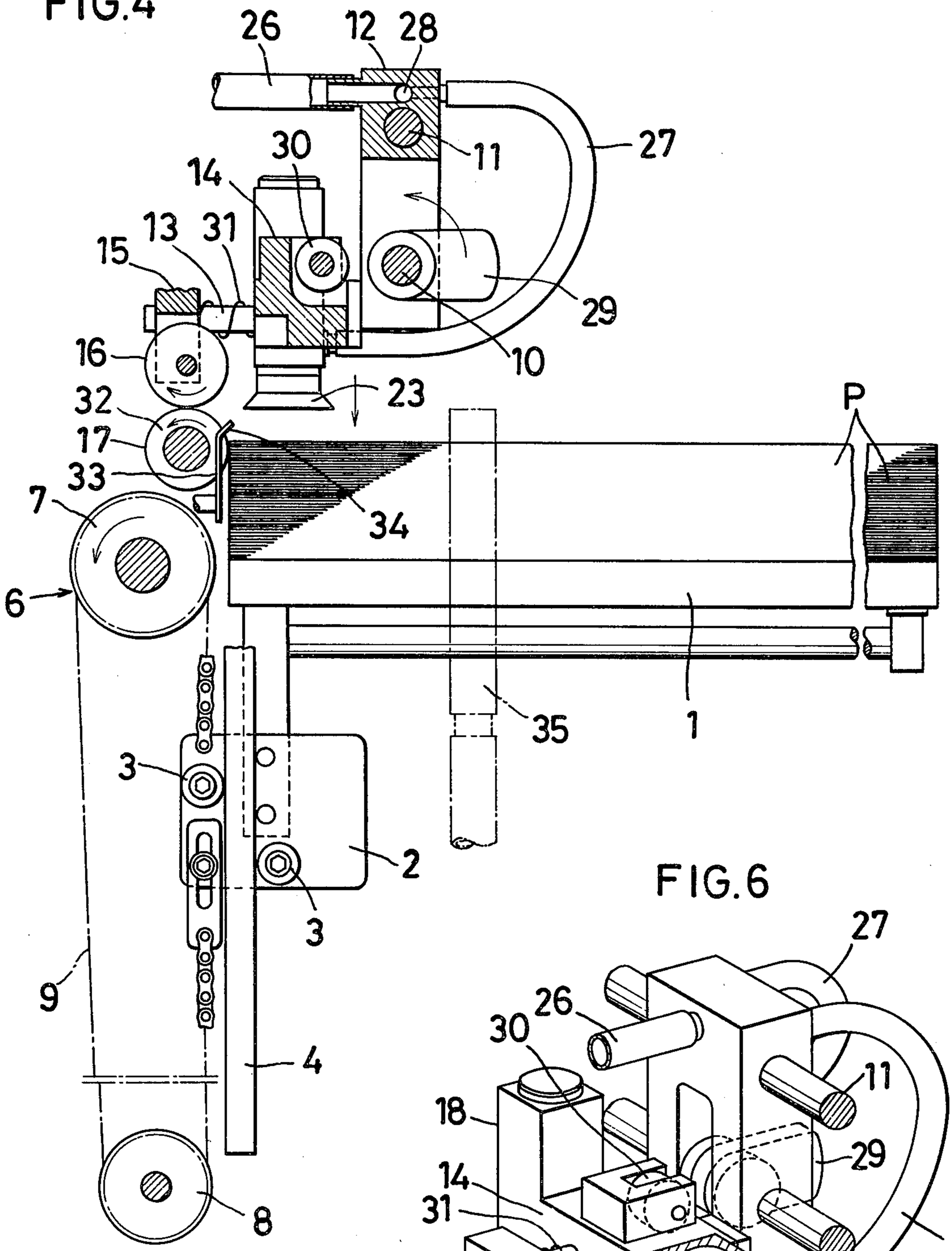

26
12
28
27
30
11
14
13
31
15
29
10
16
23
32
17
33
34
P
7
6
35
1
3
2
3
9
4
8

FIG.6

27
26
30
11
18
29
14
31
27
10
15
16
13
18
23

FIG. 5

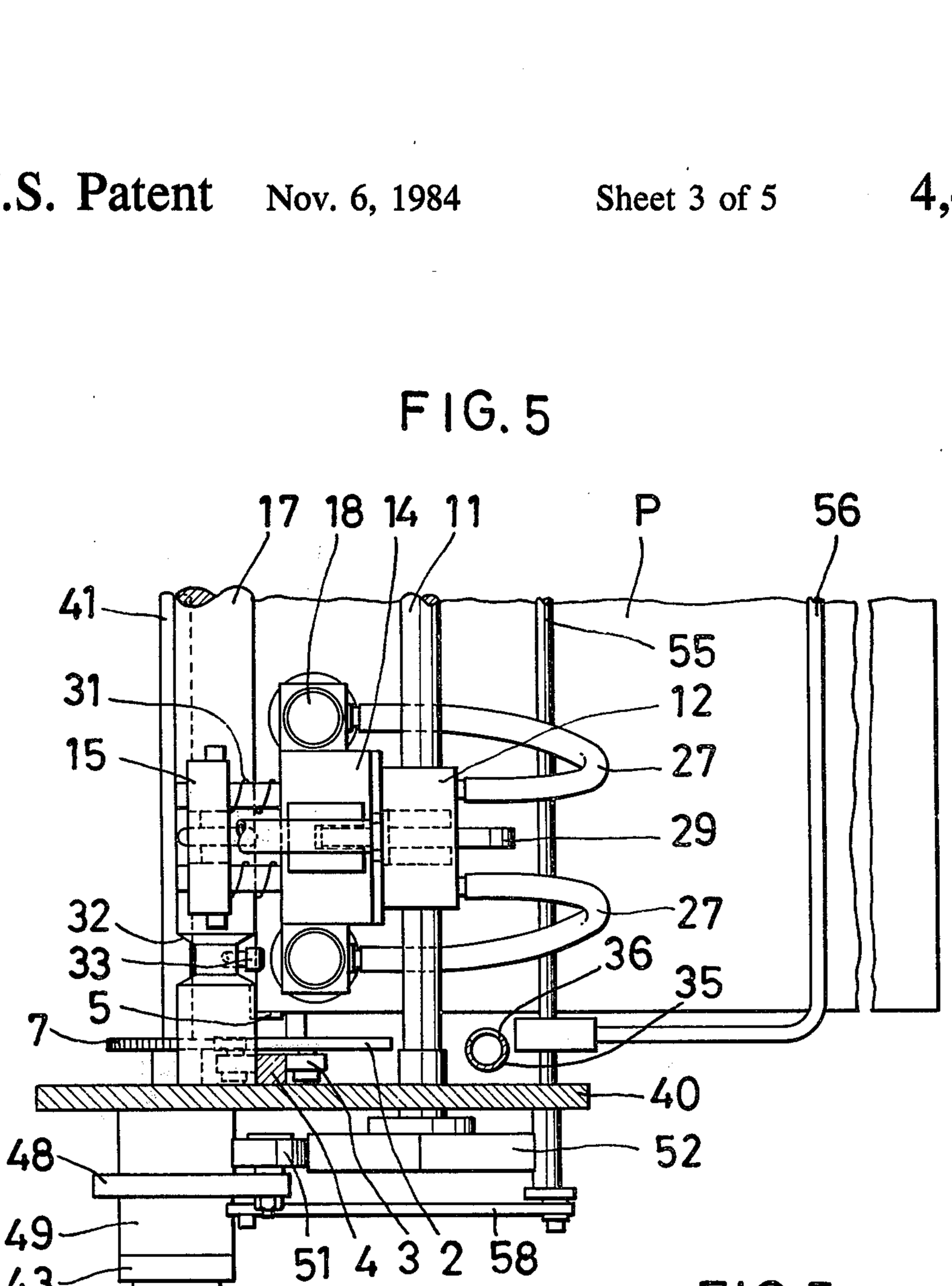

17
18
14
11
P
56
41
55
31
12
15
27
29
27
32
36
33
35
5
7
40
48
52
49
51
4
3
2
58
43
44
42

FIG. 7

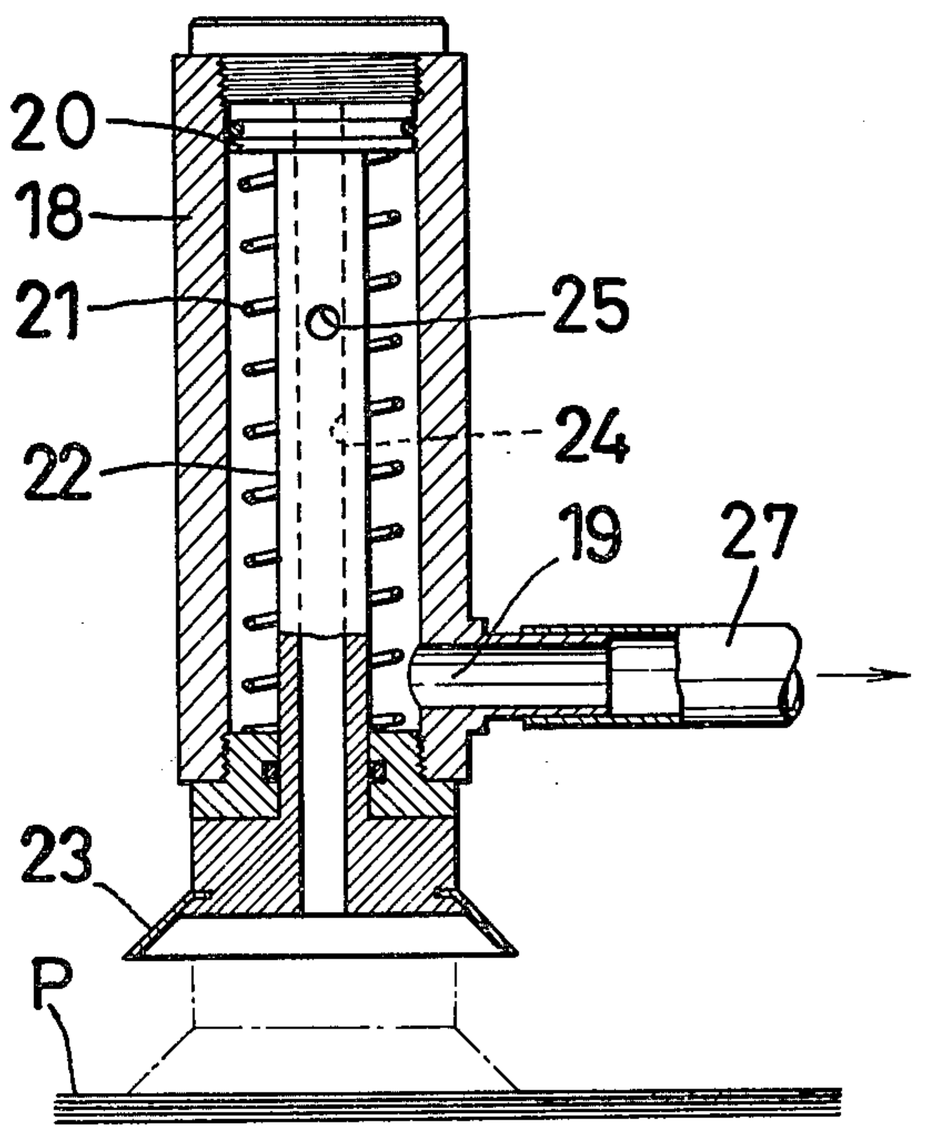

20
18
21
25
24
22
19
27
23
P

FIG.8

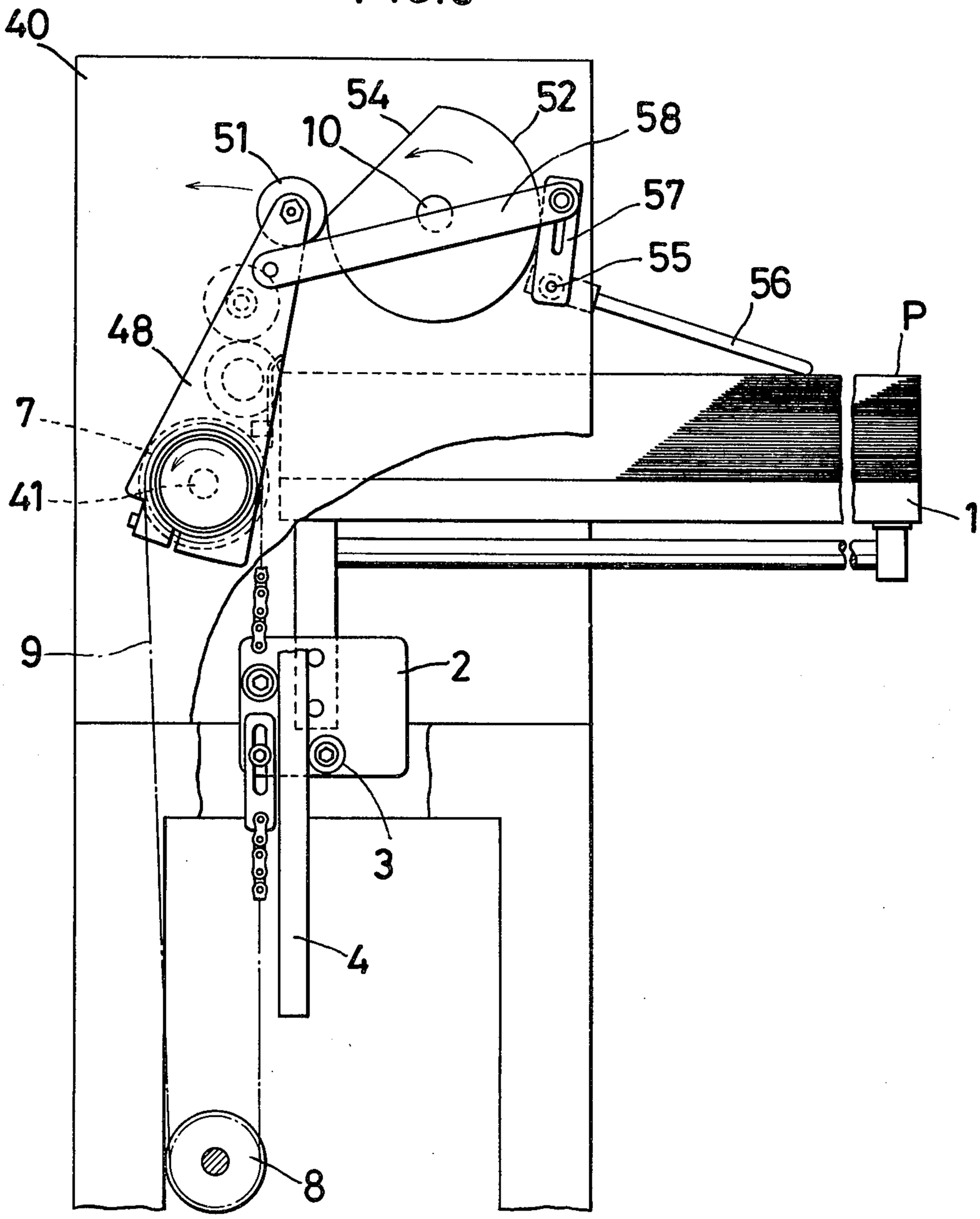


FIG.9

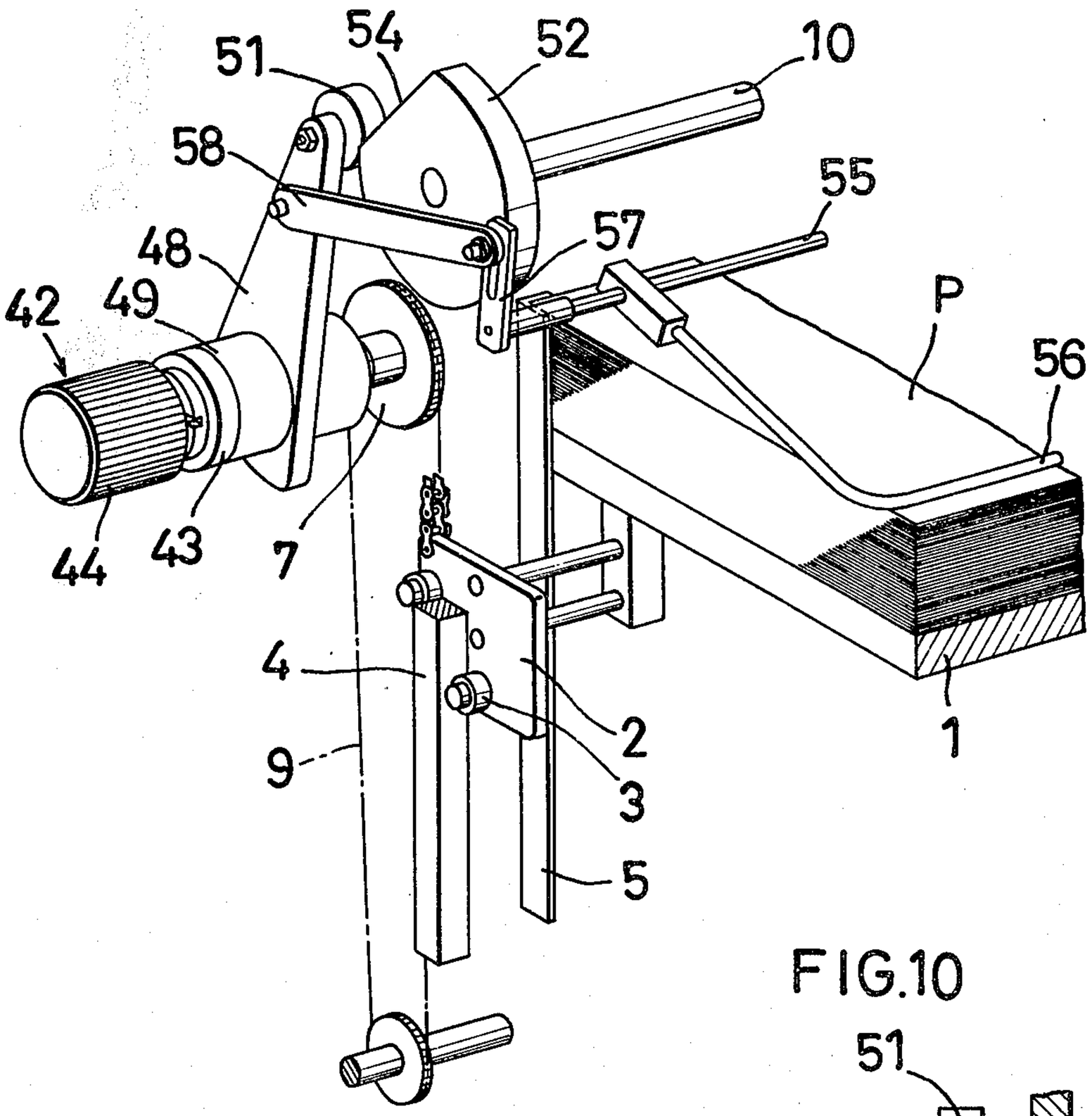
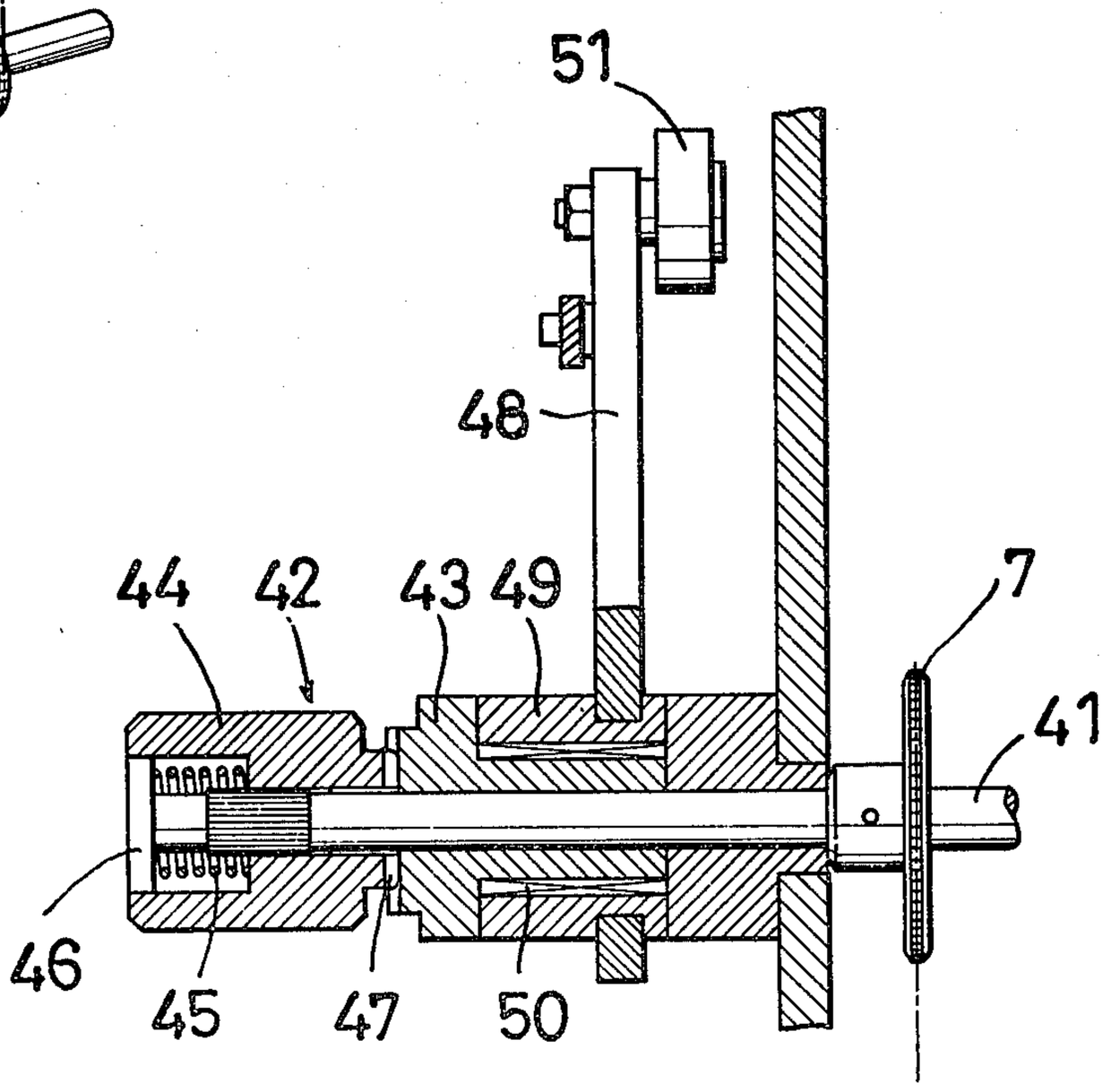

51
54
52
10
58
55
57
48
49
42
P
56
44
43
7
4
2
9
3
5
1

FIG.10


51
48
44
42
43
49
7
41
46
45
47
50

PAPER FEEDER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a paper feeder for feeding sheets of paper continuously one after another from a stack of papers on a paper table in a printing machine. 2. Description of the Prior Art

Among known paper feeders, there are two types, one is the friction type such as the koenig type and the rotary type, and the other is the suction type among which there are the universal feeder, the Dexter feeder, and the stream feeder. With the stream feeders sheets of paper are fed shingled while with the universal and Dexter feeders they are fed sheet by sheet.

The universal feeder has two types. One is shown in FIG. **1** in which a suction pad **23** is lowered on to a stack of papers P and, after sucking a paper P, goes up and forward in a loop. The other is shown in FIG. **2** in which the suction pad **23** already in a down position sucks a sheet of paper P and goes up forward in a loop. However, both of the types are slow in action, resulting in a low paper feed speed. Further, the driving mechanism for the suction pad is complicated and time-consuming for assembly.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a paper feeder which can feed sheets of paper at a high speed and is more simple in construction.

In accordance with the present invention, as shown in FIG. **3**, a suction pad **23** elevatably supported by a suction head **14** is lowered on to a stack of papers P by means of suction force supplied to suck up the paper P, goes up by the bias of a spring and is pushed forward by a cam to feed the paper P forward and urged back by a spring. Papers P can be fed from a stack of papers P at a high speed by vertical and horizontal movements of the suction pad **23**. Because of simple construction, the paper feeder according to this invention is less liable to cause trouble and is easy to assemble.

Other features and advantages of the present invention will become apparent from the following description taken with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic view showing the movement of a suction head on a conventional paper feeder;

FIG. **2** is a similar view of another conventional paper feeder;

FIG. **3** is a similar view of a paper feeder embodying the present invention;

FIG. **4** is a vertical sectional view of the embodiment;

FIG. **5** is a plan view of the same;

FIG. **6** is a partially cutaway perspective view of a portion of the same;

FIG. **7** is a sectional view of the cylinder;

FIG. **8** is a sectional view showing the table elevating mechanism used in the embodiment;

FIG. **9** is a perspective view of the same; and

FIG. **10** is a sectional view of the same including clutches.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIGS. **4** to **7**, a paper table **1** for supporting a stack of paper P is supported by a bracket **2**. A plurality of rollers **3** are mounted on the bracket to be disposed on each side of a fixed guide rail **4** so as to be guided thereby. Inside of the guide rail **4**, there is provided an L-shape paper guide **5** (FIG. **5** only). The paper table **1** is elevatable along the paper guide **5** and the guide rail **4**. When several sheets of papers P are fed from the paper table **1** so that the top level of the paper stack will lower, a table drive unit **6** will operate to raise the table **1**, thereby maintaining the top of the paper stack at the same height.

As shown in FIG. **4**, the table drive unit **6** has a pair of sprockets **7** and **8** provided in front of the paper table **1**, and a chain **9** passing around the sprockets **7** and **8** and having two ends connected to the bracket **2**. When some sheets of paper P are fed from the paper table **1**, the upper sprocket **7** will be rotated in the direction of an arrow indicated in FIG. **4** so that the paper table **1** will go up to the original height. How the table **1** is raised will be described below.

Over the paper table **1**, there are provided a driving shaft **10** and a guide shaft **11** parallel to each other. These shafts **10** and **11** extend through a support block **12**. Two guide bars **13** extend forwardly from the bottom front of the support block **12**. A suction head **14** is supported to be movable along the guide bars **13**. A roller support **15** is mounted on the ends of the guide bars **13** to support rotatably an upper feed roller **16**.

A lower feed roller **17** provided under the upper feed roller **16** is driven by a suitable drive unit to rotate in the direction of an arrow indicated in FIG. **4**. The lower feed roller **17** cooperates with the upper feed roller **16** to feed the paper blanks P to the left on FIG. **4**.

As shown in FIG. **6**, a cylinder **18** is provided on each side of the suction head **14** and has a suction port **19** at its bottom. See FIG. **7**. Each cylinder **18** has a piston **20** adapted to slide up and down therein and a spring **21** urging the piston **20**. A rod **22** extends from the bottom of the piston **20** beyond the lower end of the cylinder **18** and has a suction pad **23** mounted at its end.

The piston **20** and the rod **22** are formed with a suction path **24** extending therethrough. The suction path **24** communicates with the inside of the cylinder **18** through a hole **25** in the wall of the rod **22**.

As shown in FIG. **4**, a suction hose **26** and two hoses **27** (see FIGS. **5** and **6** also) are connected to the upper part of the support block **12** and communicate with each other through a path **28** formed in the support block **12**. The other ends of the hoses **27** are connected to suction ports **19** of the cylinders **18** provided in the suction head **14**.

The driving shaft **10** supporting the support block **12** is driven by a suitable driving unit to rotate in the direction of an arrow indicated in FIG. **4**. As the shaft **10** turns, a cam **29** mounted thereon engages a cam follower **30** mounted on the suction head **14**, moving the suction head **14** forwardly. It is urged backwardly by coil springs **31** mounted on the guide bars **13**.

In operation as shown in FIG. **4**, the paper blanks P on the paper table **1** are fed one after another by suction force supplied from the suction hose **26**. The driving shaft **10** is kept turning in the direction of the arrow.

When suction force is applied through the suction hose **26**, negative referring to FIG. **7**, it will be seen that

pressure will prevail in the cylinders **18** and pass to the suction pad **23** through the suction path **24** and the hole **25** so that the topmost paper blank P will be sucked up by the suction pad **23**.

When the lower end of the suction pad **23** is open, the suction force acting at the hole **25** is smaller than that acting on the bottom surface of the piston **20** because of smaller effective area. Therefore, the piston **20** will go down against the bias of the spring **21** and the suction pad **23** will go toward the stack of paper blanks P on the paper table **1**.

When the suction pad **23** has gone down to the uppermost paper blank P so that its lower end is closed, the upper chamber and the lower chamber in the cylinder **18** defined by the piston **20** will be under an equal pressure since they commumicate with each other through the suction path **24** and the hole **25**. Because the piston **20** is urged upward by the spring **21**, it will go up together with the suction pad **23** sucking the uppermost paper blank P.

When the suction pad **23** has come up to such a position that it butts the lower end of the cylinder **18** or the piston **20** butts the upper end plate of the cylinder **18**, referring back to FIG. **4**, the cam **29** begins to push the cam follower **30** and thus the suction head **14** forwardly along the guide bar **13**.

As the suction head **14** moves forward, the paper blank P sucked thereby gets nipped between the upper and lower feed rollers **16**, **17** and is fed forward by the rotation of the feed rollers **16**, **17**. Then the cam **29** begins to release the cam follower **30** so that the suction head **14** is pushed back by the spring **31** until the back surface of the suction head **14** butts the support block **12**. Now, the rear end of the paper blank P comes off the suction pad **23** so that its lower end will be open. Therefore, it again goes down to catch the paper blank P. This cycle is repeated.

The lower feed roller **17** is formed with a plurality of peripheral grooves **32**. A claw **33** with a bend **34** at its upper end is disposed in each groove **32**. The bend **34** prevents more than one paper blank P from being fed by the suction pad **23** at a time.

An air blow pipe **35** is provided at each side of the paper table **1** (FIG. **4**) to blow air through a slit **36** (FIG. **5**) in the pipe **35** toward the side of the paper blank P, thereby ensuring the separation of the paper blanks P into individual ones.

The number of the suction heads **14** may be decided according to the size of the paper blanks P.

Next, how the paper table **1** is raised will be described with reference to FIGS. **8–10**.

The upper sprocket **7** is disposed inside of a side frame **40** and has a shaft **41** extending through the side frame **40**. To the end of the shaft **41** as shown in FIGS. **9** and **10**, there is connected a dog clutch **42** having an input clutch **43** and an output clutch **44**. The input clutch **43** is mounted so as to be turnable with respect to the shaft **41** but not movable axially. The output clutch **44** is mounted to be axially slidable but not turnable with respect to the shaft **41**. As shown only in FIG. **10**, a spring **45** is supported on an end plate **46** of the shaft **41** to urge the output clutch **44** toward the input clutch **43**. Their claws **47** engage each other.

A cam lever **48** has a tubular portion **49** mounted on the input clutch **43**. Between the tubular portion **49** and the input clutch **43**, there is provided a one-way clutch **50** which coupled the cam lever **48** to the input clutch **43** only when the former sways in the direction of an arrow shown in FIG. **8**.

Referring to FIG. **8**, a cam follower **51** is rotatably supported at the other end of the cam lever **48**. The cam follower **51** is associated with a disc cam **52** fixedly mounted on one end of the driving shaft **10** which is kept turning in one direction. The disc cam **52** has a flat portion **54**. When it makes a full turn, the cam lever **48** does one swaying motion around the shaft **41**.

A support bar **55** disposed over the paper table **1** has its end rotatably supported by the side frame **40**. An L-shaped detection bar **56**, best shown in FIG. **9**, is rockably connected to the support bar **55** and is inclined downward to its end. A crank arm **57** is attached to one end of the support bar **55**. A link **58** couples the crank arm **57** to the cam lever **48**. When the cam lever **48** rocks, the support bar **55** turns by a certain angle so that the detection bar **56** rocks up and down.

When several paper blanks P are fed from the paper table **1**, some clearance will be formed between the detection bar **56** and the top surface of the stack of the paper blanks P on the paper table **1**. In this state, the rotation of the disc cam **52** by the shaft **10** in the direction of the arrow (FIG. **8**) causes the cam lever **48** to rock. Only when the cam lever **48** moves to the left in FIG. **8**, the one-way clutch **50** (FIG. **10** only) will operate so that the input clutch **43** (FIGS. **9** and **10**) will turn. Rotation of the input clutch **43** is transmitted to the output clutch **44** on one end of the shaft **41** and to the upper sprocket **7** on the opposite end of the shaft **41**. When the cam lever rocks to the right in FIG. **8**, the one-way clutch **50** (FIG. **10** only) will not operate so that the upper sprocket **7** does not turn. In short, with some clearance present between the detection bar **56** and the top of the stack of paper blanks P, the upper sprocket **7** will turn intermittently in the direction of the arrow (FIG. **8**) as the cam lever **48** rocks. As shown in FIG. **8**, the chain **9** runs around the upper sprocket **7** and the lower sprocket **8** in the direction of the arrow so that the paper table **1** will go up.

On the other hand, the rocking motion of the cam lever **48** is transmitted through the link **58** to the crank arm **57**, so that the support bar **55** will turn and thus the detection bar **56** will move up and down.

When the paper table **1** goes up to such a position that the top of the stack of paper blanks P abuts the detection bar **56** (FIG. **8**), the latter is prevented from rocking downward. Therefore, the crank arm **57** and the link **58** cannot move any more. In this position, the cam follower **51** is kept away from the flat portion **54** of the disc cam **52** turning continually. Therefore, the upper sprocket **7** will not turn so that the paper table **1** will not go up further.

When the paper blanks P are fed from top of their stack so that its top level lowers and some clearance is formed under the detection bar **56**, the paper table **1** will be raised again by the above-mentioned arrangement.

When all the paper blanks P have been fed or when work is stopped, the driving shaft **10** is stopped and, as shown in FIG. **10**, the output clutch **44** is pulled against the bias of the spring **45** out of engagement with the input clutch **43**. Now, the shaft **41** of the upper sprocket **7** becomes free and rotates under the weight of the paper table **1**. When the output clutch **44** is released, the claws **47** will engage again and the paper table **1** will stop lowering. By repeating the pulling and releasing of the output clutch **44**, the paper table **1** can be lowered to a desirable height. After replenishment of the sheets of

paper P, the output clutch **44** can be manually turned to turn the upper sprocket **7** to raise the paper table **1**.

Although the present application has been described with reference to a preferred embodiment, it is to be understood that various changes and variations can be made within the scope of the present invention.

What is claimed is:

1. A paper feeder for feeding blanks one after another, said paper feeder comprising:

a paper table vertically movable for supporting a stack of blanks,

a suction head provided over said paper table to be movable back and forth and having a cylinder,

said cylinder having a suction port for connection to a source of suction force and having a piston elevatably mounted and a spring means for urging said piston upwardly, said piston having a rod connected to its lower end,

a suction pad means, mounted to a lower end of said rod, for sucking up the blanks one after another,

said piston and said rod having a suction path extending axially therethrough and said rod also having a hole means in its wall for communicating said suction path with the inside of said cylinder,

a driving shaft provided behind said suction head,

a cam means, mounted on said driving shaft, for moving said suction head forwardly,

a spring means for urging said suction head backward toward said cam means, and

a table drive means for raising said paper table to keep the top level of the stack of blanks at a predetermined height, said table drive means comprising:

a pair of sprockets;

a chain or belt means running around said sprockets and connected to said paper table,

a dog clutch provided at one end of a shaft of one of said sprockets, said dog clutch having an input clutch which is not axially movable but rotatable with respect to said shaft,

a cam lever connected to said input clutch,

a one-way clutch means, provided between said cam lever and said input clutch, for coupling the cam lever and the input clutch together,

a cam means, fixedly mounted on said driving shaft, for rocking said cam lever,

said dog clutch transmitting the rocking motion of said cam lever to said shaft of one of the sprockets, thereby rotating it and thus raising said paper table,

a support bar means for extending transversely over said paper table so as to be rotatable,

a detection bar means, rockably connected to said support bar, for limiting the raising of said paper table, and

a crank arm and a link means for coupling said support bar means to said cam lever.

2. A paper feeder having a table drive means for raising a paper table to keep the top level of the stack of blanks at a predetermined height, said table drive means comprising:

a pair of sprockets,

a chain or belt means running around said sprockets and being connected to said paper table,

a dog clutch provided at one end of a shaft of one of said sprockets, said dog clutch having an input clutch which is not axially movable but rotatable with respect to said shaft,

a cam lever connected to said input clutch,

a one-way clutch means, provided between said cam lever and said input clutch, for coupling the cam lever and the input clutch together,

a cam means, fixedly mounted on a driving shaft, for rocking said cam lever,

said dog clutch transmitting the rocking motion of said cam lever to said shaft of one of the sprockets, thereby rotating it and thus raising said paper table,

a support bar means for extending transversely over said paper table so as to be rotatable,

a detection bar means, rockably connected to said support bar means, for limiting the raising of said paper table, and

a crank arm and a link means for coupling said support bar means to said cam lever.

* * * * *